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OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

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REVISED LABELS AND MITIGATION REVIEW

SUBJECT: EFED Review of Lorsban*-4E, Lock-On*, and Lorsban* 15G Label Changes

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At SRRD's request, EFED reviewed the proposed label changes to some chlorpyrifos labels proposed by Dow AgroSciences. The proposed labels reviewed include Lorsban*-4E, Lorsban* 15G, and Lock-On*. The label changes are an improvement with clarification of some use limitations not included on previous chlorpyrifos labels and some risk reduction proposals such as: reductions in use rates, annual limitations on the number of applications, limits on lbs per acre per season, and most retreatment intervals set at 10 days. EFED's comments on the proposed label changes are presented below in Attachment I. EFED's suggestion in the attachment for the language on the label concerning spray drift management reflects the latest draft of comments/consensus coming out of our inter-divisional meeting with Marcia Mulkey on the subject on June 29, 2001.

A table with a comparison of the old and the proposed labels is presented in Attachment II.

SRRD also requested that EFED quantify the risks for some of the mitigation proposals made by Dow on their labels, especially those addressing risks from spray drift. Using the Ag-DRIFT Model, EFED assessed the level of risk mitigation achieved by the no-spray buffer zones proposed by Dow. EFED compared the risks posed by no buffer zone to the proposed no-spray buffer zone, and also assessed risks if there were no spray drift at all, just runoff. The assessment of risk mitigation also included whatever other modifications were proposed for that

use. Five major crop scenarios were assessed for buffer zones mitigation. EFED's assessment suggests that risks would be reduced, except for the citrus air-blast scenario. Changes in citrus exposure levels are insignificant. However, even with mitigation there are still level of concern exceedences for all aquatic risk categories. The spray drift mitigation assessment is included as Attachment III. Please note that the spray drift mitigation assessment is preliminary and should not be considered as official EFED policy. EFED's standard operating procedure for using AgDRIFT has not been finalized.

Attachment I.

EFED has reviewed the proposed label changes for Lorsban*-4E, Lock-On*, and Lorsban* 15G. The registrant has proposed some modifications of use rates. Generally, they increased the minimum intervals between applications, deleted some application methods, substituted some safer application methods, reduced a few application rates, and put seasonal limitations on the number of applications and the poundage of chlorpyrifos to be applied seasonally. The label also added spray drift warnings and set no-spray buffer zones for ground, chemigation, orchard airblast, and aerial applications. The label format and information added to the new label are a definite improvement over the older labels.

EFED's review addresses the issues in the following order:

Part 1. Recommended "spray drift" guidance for all agricultural labels employing spray applications.

Part 2 . EFED comments on the proposed changes to Lorsban* -4E, Lock-On* and Lorsban* 15G labels.

Part 1. EFED has some comments on the label addressing spray drift:

> There appears to be a reversal of the wind speed limitations for aerial and ground applications. It is unclear why restrictions for ground applications are more stringent than for aerial applications.
>
> Some areas of concern have been found in the precautionary label. EFED recommends the following label language.
>
> 1. Substitute "no-spray buffer zone" where the term "buffer zone" appears.
>
> 2. All references about wind direction with respect to the no-spray buffer zone need to be deleted.
>
> 3. EFED recommends adding the appropriate "no-spray buffer zone" requirement(s) to the "Restrictions" at the end of each crop.

EFED recently reviewed the label guidance statements proposed by Dow on a new formulation, Lorsban* 75WG. A part of that label proposal was a section on no-spray buffer zones to reduce spray drift levels which would help protect fish and other aquatic organisms in aquatic habitats. EFED recommended a few modifications in the wording of the Lorsban* 75WG label. EFED recommends that the following spray drift management guidance be placed on the labels of Lorsban* 4E and Lock-On* which were provided for review.

SPRAY DRIFT MANAGEMENT

Do not allow spray drift to contact people or their living or working places, nontarget property on which structures are located, animals, recreation sites, areas where children play, nature preserves, wildlife refuges, parks, lakes, reservoirs, rivers, streams, non-irrigation canals, ponds, estuaries, wetlands, intertidal areas, forests, woodlands, pastures, rangeland, grasslands, nontarget crops, or ecologically significant sites.

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator is responsible for considering all these factors when making the decision to apply this product.

Observe the following precautions when spraying Lorsban 75WG adjacent to permanent bodies of water such as rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries, and commercial fish ponds.

The following treatment setbacks or no-spray zones must be utilized for all applications from the above listed aquatic areas with the following equipment:

Application Method	Required Setback (No-spray Zone)
Ground Boom	25 feet
Chemigation	25 feet
Orchard Airblast	50 feet
Aerial (fixed wing or helicopter)	150 feet

Making applications when wind is blowing away from sensitive areas is the most effective way to reduce the potential for adverse effects.

The following mandatory spray drift **best management practices** are required to reduce the likelihood of off-target drift movement from applications.

Aerial Application:

1. The distance of the outer most nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.
2. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.
3. Nozzles must produce a medium or coarser droplet size (255-340 microns volume median diameter), per ASAE Standard 572 under application conditions. Airspeed, pressure, and nozzle angle can all affect droplet size. See manufacturer's catalog or USDA/NAAA Applicator's Guide for spray size quality ratings.
4. Applications must not be made at a height greater than 10 feet above the top of the target plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

5. Do not apply product when wind speed exceeds 10 mph.
6. Where states have more stringent regulations, they must be observed.

The applicator should be familiar with and take into account the information covered in the Aerial Drift Reduction Advisory.

Aerial Drift Reduction Advisory

[This section is advisory in nature and does not supercede the mandatory label requirements.]

INFORMATION ON DROPLET SIZE

The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent adverse effects from drift if applications are made improperly, or under unfavorable environmental conditions (See Wind, Temperature and Humidity, and Temperature Inversions).

CONTROLLING DROPLET SIZE

- Volume - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.

- Pressure - Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.

- Number of nozzles - Use the minimum number of nozzles that provide uniform coverage.

- Nozzle Orientation - Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.

- Nozzle Type - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

BOOM LENGTH

For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

APPLICATION HEIGHT

Applications should not be made at a height greater than 10 feet above the top of the target plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

SWATH ADJUSTMENT

When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator should compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase, with increasing drift potential (higher wind, smaller drops, etc.).

WIND

Drift potential is lowest between winds speeds of 2 - 10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given speed. Application should be avoided below 2 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

TEMPERATURE AND HUMIDITY

When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

TEMPERATURE INVERSIONS

Applications should not occur during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

SENSITIVE AREAS

The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g. when wind is blowing away from the sensitive areas).

Ground Boom Application:

The following mandatory spray drift **best management practices** are required to reduce the likelihood of off-target drift movement from ground applications.

1. Choose only nozzles and pressures that produce a medium or coarse droplet size (255-400 microns volume median diameter), per ASAE Standard 572. See manufacturer's catalog or USDA/NAAA Applicator's Guide for spray size quality ratings.
2. Make applications with nozzle tips no more than 2 feet above the ground or crop canopy. Making applications at the lowest height reduces exposure of droplets to evaporation and wind.
3. Do not apply product when wind speed exceeds 10 mph.

Orchard Airblast Application:

The following mandatory spray drift **best management practices** are required to reduce the likelihood of off-target drift movement from airblast applications.

1. Nozzles must be directed so spray is not projected above the canopies.
2. Do not apply product when wind speed exceeds 10 mph for aerial and ground applications.
3. Outward pointing nozzles must be shut off when turning corners at row ends.

The applicator should take into account the following **best management practices** to reduce off-site spray drift. [This section is advisory and does not supercede mandatory label requirements.]

1. Number of nozzles, nozzle orientation and spray volume, air speed and wind direction are key factors in adjusting airblast spray delivery to match the height and density of the crop canopy. Airblast equipment should be adjusted to provide uniform coverage while minimizing the amount of spray movement over-the-top or completely through the crop canopy.

    - High air volumes deliver spray more efficiently than air at high speed. Reducing forward travel speed decreases the air speed necessary to deliver the spray to the top of the crop canopy.
    - Use air guides along with the number and orientation of spray nozzles to achieve the desired spray coverage and directional control.

2. The following steps should be taken to minimize drift and the amount of non-target spray:
    - Orient nozzles and adjust air speed/volume/direction to minimize spray movement over-the-top and avoid forcing the spray completely through the crop canopy.
    - Shut off spray delivery when passing gaps in crop canopy within rows.
    - Spray the outside rows or orchards from in, directing the spray into the orchard and shutting off nozzles on the side of the sprayer away from the orchard.
    - When treating smaller trees, vines or bushes, shut off nozzles to minimize over-the-top spray movement.

Part II. EFED Comments on Proposed Label Use Changes:

SRRD has indicated their desire that in no case, should the revised label include new uses or increase the use rates, number of applications, or the maximum poundage per acre per season for existing uses on the Lorsban labels. In part, the label revisions are an effort to reduce risks to fish and wildlife with buffer zones around aquatic areas, reductions in use rates, number of applications and maximal seasonal use rates, as well as an increase in the minimum intervals for retreatment.

EFED has reviewed the proposed label revisions for Lorsban* -4E, Lock-On*, and Lorsban* 15G. The use information from the old and new labels was entered into a table in Appendix I on a crop-by-crop basis. Comparison of the labels included: maximum use rates, the number of applications, the minimum interval between applications, and the total poundage allowed per season.

EFED found the new labels easier to understand and found them to be more complete, especially with respect to the minimum interval between applications and maximum seasonal poundage. The addition of the restriction limiting the use of other chlorpyrifos products has been noted for many crops. Some use patterns have been changed which may reduce exposures to terrestrial wildlife. For example, the new Lorsban* 15G label replaced band treatments with T-band applications. While chlorpyrifos exposures have not been eliminated, the number of granules on the soil surface available to birds as grit are reduced. Several regional crop uses, such as cotton in AZ and CA, corn in FL and GA, and tobacco in NC, SC, and VA, with particularly high application rates have had their use rates sharply reduced. Seasonal limits have been reduced for several crops including: citrus orchard floors, corn, cotton, sugar beets, sunflowers, etc. All these changes are modifications in the direction of reducing risks to terrestrial and aquatic organisms. In some cases, missing use information should be added to the new labels for clarity. For example, the seasonal poundage limitations may not be obvious, if other chlorpyrifos formulations can be used at a different use rates.

Part II. A. EFED recommends the following modifications on the new Lorsban* -4E label:

Page 15. Alfalfa: Add the seasonal poundage limitation for chlorpyrifos.

Page 16. Asparagus: Add the seasonal poundage limitation for chlorpyrifos.

Page 17. Christmas trees: Add the seasonal poundage limitation for chlorpyrifos.

Page 20. Corn: The following restrictions for feeding livestock appear to be inconsistent.

- Do not feed treated corn fodder to meat or dairy animals within **35 days** after last treatment.
- Do not allow livestock to graze in treated areas nor harvest treated corn silage as feed for meat or dairy animals within **14 days** after last treatment.

Page 24-25. Cranberries: Add the seasonal poundage limitation for chlorpyrifos.

Page 26. Onions (Dry Bulb): Add the seasonal poundage limitation for chlorpyrifos.

Page 29. Soybeans: The old Lorsban* 4E has a minimum of 14 days between treatments. Please change the number back to 14 days.

Page 29-30. Strawberries: Add the seasonal poundage limitation for chlorpyrifos.

Page 36. Peaches / nectarines: The use rate (430 qt/100 gal.) is a misprint. The rate should be "3.0 qt/100 gal."

Page 37. Cherries: Add the seasonal poundage limitation for chlorpyrifos use for trunk treatments.

Page 37. Pecans: The use rate for ants on the pecan orchard floor was increased from 1 to 2 lbs ai./A to 2 to 4 lbs ai./A. Since increases in use rates are not permitted, the use rate should remain at a maximum of 1 to 2 lbs ai./A.

Page 39. Brussel Sprouts: Add the seasonal poundage limitation for chlorpyrifos.

Page 39. Wheat: Wheat was not previously listed on the Lorsban*-4E label. The no-spray buffer zone proposed for wheat is greater than those proposed for other chlorpyrifos uses (i.e., 30 feet for ground application and 300 feet for aerial application versus 25 and 150 feet, respectively). The reason for the larger no-spray zone is that the prairie pothole region is an important waterfowl breeding area which is dependent on aquatic invertebrates to feed the young birds and needs more protection than other crop areas.

Page 40. Wheat: Add the seasonal poundage limitation for chlorpyrifos.

Part II. B. EFED comments on the proposed Lock-On* label changes.

Page 8. Wind speeds are inverted for ground and aerial spray applications. The "spray drift" guidance text cited in Part I should also replace the section on the Lock-On* label.

Page 9. Alfalfa: Under "Restrictions" the reference to "Do not make more than 4 applications per year ..., appears to be inconsistent with the changes cited on page 11 in the Chlorpyrifos Risk Mitigation memo by Jachetta *et al.*, Aug. 28, 2000. The old rate was 4 applications; 3 applications would be an improvement. Add the seasonal poundage limitation for chlorpyrifos on alfalfa.

Part II. C. EFED comments on the proposed Lorsban* 15G label changes.

Page 7-8. Corn: Pesticidal statement about "suppression of certain soil-borne pathogens that may result in physiological and agronomic advantages ..." should specify what specific soil-borne pathogens data exist. On the Lorsban labels references are made to pest species that are suppressed and in all cases but in this case, the pathogen(s) should specified and a application rate is specified. The phrase "may result" is too imprecise and appears to reflect uncertainty. Such a claim does not appear on the Lorsban*-4E label.

Page 8. There appears to be an omission of use information for the flea beetle. The flea beetle is listed as a pest for corn, but there is no indication what application method is appropriate and what use rate should be used to control it.

Page 9. There appears to be inconsistency in the "Restrictions" for the feeding of treated corn silage to livestock (i.e., 14 days or 35 days after last treatment).

Page 10. Sorghum/Milo: The restrictions allow only one application at 8 oz. (1.2 oz. ai.) per 1,000 feet of row. Please designate the maximum poundage per season.

Page 12. Soybeans: The restrictions allow one granular application at 8 oz. (1.2 oz. ai.) per 1,000 feet of row and 2 foliar applications. Please designate the maximum poundage per season for soybeans.

Page 13. Add the maximum poundage per season for all chlorpyrifos uses on sunflowers.

Attachment II. Comparison of use information on the old and the proposed labels.

Lorsban* 4E: Old label (dated 09/27/00) versus New label (08/15/00)								
Registered Crop Uses	Use Rates (lbs ai/A)		Maximum No. of Applications		Min. Retreatment Interval (days)		Max. Seasonal Limitation (lbs ai/A)	
	Old	Proposed	Old	Proposed	Old	Proposed	Old	Proposed
Alfalfa	0.25 - 0.5 0.5 - 1.0	0.25 - 0.5 0.5 - 1.0	4 1/cutting	4 1/cutting	-	10	????	????
Asparagus	1.0	1.0	3	3	-	10	????	????
Christmas trees Foliar Trunk	1.0 3/100 gal.	1.0 3/100 gal.	-	3	7 - 10	7	????	????
Citrus Fruits Foliar Floor	1.0 - 6.0 0.75-1.0	1.0 - 6.0 0.75-1.0	2 as needed	2 3	30 as needed	30 10	7.5 10	7.5 3
Corn Preplant Incorp. Preplant Cons. T-Band at Plant Foliar FL & GA	 1.0 - 3.0 0.5 - 1.0 2.4 fl. oz. 0.25- 1.5 0.5 - 1.0	 1.0 - 3.0 0.5 - 1.0 2.4 fl. oz. 0.25- 1.0 N/A	 1 or or 3 11 or 22	 1 or or 2 or 3 N/A	 N/A N/A N/A - as needed	 10	7.5 11	3.0 N/A
Cotton CA & AZ	0.19- 1.0 0.5 - 1.0	0.19- 1.0 0.5 - 1.0	6	3	-	10	6	3
Cranberries	1.5	1.5	2	2	-	10	3	3
Figs (CA only)	2.0	2.0	1	1	N/A	N/A	2	2
Grapes	2.0/15 ft^2	2.0/15 ft^2	1	1	N/A	N/A	????	????
Mint Preharvest Postharvest	1.0 - 2.0	1.0 - 2.0	1 1	1 1	N/A	N/A	????	????
Onions	1.1 fl. oz.	1.1 fl. oz.	1	1	N/A	N/A	????	????
Peanuts Preplant Postplant	2.0	2.0	1 or	1 or	> 21	> 21	4	4
Sorghum	0.25- 1.0	0.25- 1.0	-	3	-	10	1.5	1.5
Soybeans	0.5 - 1.0	0.5 - 1.0	-	3	14	10	3	3
Lorsban* 4E: Old label (dated 09/27/00) versus New label (08/15/00) (cont.)								

Strawberries Preplant Foliar	2.0 1.0	2.0 1.0	1 2	1 2	N/A -	N/A 10 - 14	4	4
Sugar Beets Preplant band Foliar broadcast Foliar band	0.5 0.25- 1.0 0.33- 1.0	0.5 0.25- 1.0 0.33- 1.0	4	3	- - -	10	4	3
Sunflowers Preplant Foliar	1.0 - 2.0 0.5 - 1.5	1.0 - 2.0 0.5 - 1.0	3 1 2	3	N/A 7 - 10	10	4.5	3
Sweet Potatoes	2.0	2.0	1	1	N/A	N/A	2	2
Tobacco NC, SC, VA	2.0 - 3.0 5.0	2.0 -	1 1	1 -	N/A N/A	N/A -	3	2 -
Tree Fruits: Dormant: Apples, pears, plums, prunes, almonds (limited use areas in CA), peaches, nectarines								
Fruit trees (listed above)	0.25- 0.5/ 100 gal. min. 0.75 lbs ai/A	0.25- 0.5/ 100 gal. min. 0.75 lbs ai/A	1	1	N/A	10	min. of 0.75 lbs ai/A	2
Sour Cherries Dormant Trunk	0.25- 0.5/ 100 gal.	0.25- 0.5/ 100 gal. min. 0.75 lbs ai/A	3 1 2 or 3	1 -	N/A	N/A	????	2
Tree Fruits and Tree Nuts: Foliar (Not on apples)								
Almonds	2.0	2.0	3	3	-	10	???? 6	4
Cherries (Sour)	????	1.0 - 1.5		3		10		4
Filberts	1.5 - 2.0	1.5 - 2.0		3	-	10	???? 6	4
Pecans	0.5 - 2.0	0.25- 2.0	5	3	7 - 10 10 - 14	10	5	4
Walnuts	2.0	2.0	2	2	-	10	4	4
Tree Fruits and Tree Nuts: Trunk Spray								
Almonds		3.0/ 100 gal.						
Cherries (Sour)	1.5 - 3.0/ 100 gal.	1.5 - 3.0/ 100 gal.	3	3	14	????	????	????

Lorsban* 4E: Old label (dated 09/27/00) versus New label (08/15/00) (cont.)

Nectarines/ Peaches	1.5/ 100 gal.	??? 430/ 100 gal.	1	1	N/A	N/A	1.5/ 100 gal.	??? 430/ 100 gal.
Orchard Floors: Almonds, pecan and walnut								
Almonds	2.0 - 4.0	2.0 - 4.0	-	2	-	10	8	4
Pecans	1.0 - 2.0	2.0 - 4.0	????	2	-	10	????	4
Walnuts	2.0 - 4.0	2.0 - 4.0	-	2	-	10	8	4
Vegetables: Soil Applications								
Cauliflower	1.6 - 2.4 fl. oz. (1-2 lbs ai/A)	1.6 - 2.4 fl. oz. (1-2 lbs ai./A)	????	1	????	N/A	2	1
Broccoli Cabbage Chinese Cabbage Collards Kale Kohlrabi Turnips	1.6 - 2.75 fl. oz. (1.3-2.25 lbs ai/A)	1.6 - 2.75 fl. oz. (1.3-2.25 lbs ai./A)	????	1	????	N/A	????	2.25
Radishes	1.0 fl. oz. (Up to 2.75 lbs ai./A)	1.0 fl. oz. (Up to 2.75 lbs ai./A)	1	1	N/A	N/A	2.75	2.75
Rutabagas	1.6 - 3.3 fl. oz. (Up to 2.25 lbs ai./A)	1.6 - 3.3 fl. oz. (Up to 2.25 lbs ai./A)	1	1	N/A	N/A	2.25	2.25
Brussel Spouts Soil Incorp. Foliar	 1.6 - 2.75 fl.oz. 0.5 - 1.0	 1.6 - 2.75 fl. oz. 0.5 - 1.0	6 ???? ????	3 1	 ???? ????	10	???? 6	????
Wheat	0.25-0.5**	0.25 - 0.5	2	2	????	10	1	????

** Wheat is not listed on the Lorsban* -4E label. It is found on the Lorsban* 4E-SG label.

Lock-On*: Old label (dated 12/97) versus New label (08/15/00)								
Registered Crop Uses	Use Rates (lbs ai/A)		Maximum No. of Applications		Min. Retreatment Interval (days)		Max. Seasonal Limitation (lbs ai/A)	
	Old	Proposed	Old	Proposed	Old	Proposed	Old	Proposed

Alfalfa AZ & CA	0.75- 1.0	0.75- 1.0	4 1/cutting	4 or 3 (8/28/00 memo) 1/cutting	????	10	???? 4	???? 4 or 3 in memo
Cotton AZ & CA	1.0	1.0	Retreat	3	as needed	10	????	3

Lorsban* 15G: Old label (dated 01/06/00) versus New label (08/15/00)

Registered Crop Uses	Use Rates (lbs ai/A)		Maximum No. of Applications		Min. Retreatment Interval (days)		Max. Seasonal Limitation (lbs ai/A)	
	Old	Proposed	Old	Proposed	Old	Proposed	Old	Proposed
Corn								3
Preplant:								
Broadcast	1.0 - 2.0	-	1	-	N/A	N/A	2 or	
At plant:			1	1			2.4 oz.ai	1.2 oz.ai
T-band	1.2 oz. ai	1.2 oz. ai	or	or	N/A	N/A		
Band	1.2 oz. ai	-	or	-	N/A			
In-furrow	1.2 oz ai.	1.2 oz. ai	or	or	N/A	N/A		
Postplant:								
Band	0.525-1.2		1	0.525-1.2	N/A	N/A	2.4 oz.ai	2.4 oz.ai
Foliar:	oz. ai			oz. ai			or 1.95	or 1.95
Broadcast	0.75-0.98		2	0.75-0.98	???	10		
Citrus					as			
Floor	1.0	1.0	????	3	needed	10	10	3
Sorghum/Milo	oz. ai/1000	oz. ai/1000	1					
T-Band	0.6 - 1.8	0.6 - 1.2	or	1	N/A	N/A	????	????
Band	0.6 - 1.8		or		N/A			1.2 oz.ai
Onions								
At plant:	oz. ai/1000	oz. ai/1000	1	1	N/A	N/A	1	1
In-furrow	0.555	0.555						
Peanuts	oz. ai/1000	oz. ai/1000	1 or 2	1 or 2			4	4
At plant:	1.125-2.25	1.125-2.25	1	1	????	10	2.25 oz.	2.25 oz.
Postplant	1.125-2.25	1.125-2.25	1	1	????		ai/1000	ai./1000
Broadcast	1.5 - 2.0 lb/A	-	????	-			or 2 lb/A	-
Soybeans	oz. ai/1000	oz.ai/1000	1	1				
At plant:				or 2 with				
T-Band	1.2	1.2		Lorsban*-	N/A	N/A	???? 1.2	????
Band	1.2	-		4E	N/A			
Postplant	1.2	1.2			N/A	10		
Sugar Beets	oz. ai/1000	oz. ai/1000	1	1	N/A		2 lb ai/A	3 lb ai/A
At plant:				or 3 with				
T-Band	-	0.675-1.35		Lorsban*-				
Band	0.675-1.35	-		4E				
Postplant	0.975-1.35	0.975-1.35				10		

Sunflowers At plant: T-Band Band	oz. ai/1000 - 1.2 oz	oz. ai/1000 1.2 oz. -	1	1 or 3 with 4E spray	N/A	10	????	????
Sweet Potato Pre-plant Broadcast	 2.0	 2.0	1	1	N/A	N/A	????	????
Tobacco Pre-plant Broadcast	 2.0 - 3.0	 2.0	1	1	N/A	N/A	3.0	2.0
Brassica crops At plant: T-Band	oz. ai/1000 0.69- 1.38	oz. ai/1000 0.69- 1.38	1	1	N/A	N/A	1.125 40" row 2.25 22" row	1.125 40" row 2.25 22" row
Radishes At plant: In furrow	oz. ai/1000 0.495	oz. ai/1000 0.495	1	1	N/A	N/A	2.745	2.745

Attachment III. Evaluation of No-spray Buffer Zone Mitigation Proposals.

The registrant, Dow-Agrosciences has proposed using the following no-spray buffer zones to reduce risks to aquatic organisms posed by chlorpyrifos spray applications.

Application Method	Required Setback (No-spray Zone)
Ground Boom	25 feet
Chemigation	25 feet
Orchard Airblast	50 feet
Aerial (fixed-wing or helicopter)	150 feet

Background

SRRD asked EFED to assess the potential mitigation of aquatic risks that could result from no-spray buffer zones adjacent to aquatic areas. The procedures used in this assessment should be considered preliminary and are for the purpose of this exercise only. This assessment does not reflect EFED permanent policy or the input parameter guidance document.

Several factors should be kept in mind concerning the reassessment of chlorpyrifos risks with the no-spray buffer zones proposed by the registrant:

- Only five scenarios were evaluated for this exercise, and those were evaluated using the PRZM-EXAMS model. Most of the original risk scenarios in the Chlorpyrifos RED were assessed using the screening-level GENEEC model. The GENEEC model in its current form cannot calculate the potential reduction in exposure gained from no-spray zones.

- Where the PRZM-EXAMS model was used in the original assessment, the spray drift factors (expressed as a fraction of the application rate) were 1% for ground boom applications and 5% for airblast and aerial applications. These are median values taken from open literature papers. In this analysis the AgDRIFT model was used, which assumes deposition of the 90th percentile drift value from the model. Drift loadings to the water body were evaluated with and without the no-spray buffer. Because the drift fractions in the original RED differ from those employed in AgDRIFT, it would not be appropriate to consider the original default spray drift values in this comparison. Using AgDRIFT for the no-spray zone and the standard drift loading values from the original RED (and EFED's input parameter guidance) has the effect of comparing results calculated at different percentiles.

- This procedure considers only the reduction in spray drift to the body of water. The buffer's possible impact on reducing runoff is not considered because PRZM-EXAMS does not have this capability. The problem of runoff is more complicated. For

example, if runoff is channelized, the buffer zone would probably have little effect on the pesticide levels transported to the aquatic habitat.

Risk Assessment Comparisons of No Buffer, Buffers, and No Drift Scenarios:

Based on major chlorpyrifos crop uses and differences in spray application methods, five use scenarios were selected to assess the level of mitigation obtained using the proposed no-spray buffer zones. The scenarios include the major spray application methods (i.e., ground, air-blast and aerial spray applications) and the proposed changes in use rates. In two scenarios (i.e. corn pre-plant and citrus), no use modifications were proposed in the use rates or manner of application, except the no-spray drift zones. In three scenarios, the registrant has proposed reductions in the use rate (i.e., aerial corn and tobacco) or reductions in the number of applications (i.e., cotton). These proposed reductions have been included in the following risk mitigation assessment.

Chemical properties and fate parameters for chlorpyrifos remain the same as those used in the RED. To better understand the sources of risk and risk mitigation, the PRZM-EXAMS model was used to recalculate all aquatic EECs including no buffer, the proposed no-spray buffer zone and assuming that there is no spray drift at all (i.e., only runoff into the aquatic habitat).

To estimate the spray drift amount, EFED used the PRZM input parameter, DRFT, to define the off-target spray drift to the standard farm pond. For the mitigation investigations related to buffer restriction, EFED used the AgDRIFT model (version 1.07) to predict the different DRFT values for different buffer restrictions. For purposes of comparison, tier 1 of the AgDRIFT model was used.

The general parameters for tier 1 assessment are tabulated below. When using the AgDRIFT model, the user is prompted to choose tier (I, II, or III) and application method (aerial, ground, or orchard airblast). Once the tier and application method are chosen, the user then proceeds to toolbox function and chooses aquatic assessment to obtain the drift value. For the evaluation of buffer restriction, the blank for "Distance to water body from edge of field" needs to be entered. A "0" indicates no buffer restriction, and a numerical value (e.g., 50 ft) indicates the buffer restriction. The drift value, expressed as fraction of applied, is used as the "DRFT" parameter in the PRZM for drift loading to the EXAMS' standard farm pond.

GENERAL PARAMETERS FOR TIER 1 ASSESSMENT

Aerial

Aircraft Description / Operation

Type	Air Tractor AT-401
Weight of Aircraft	26683 N (5998 lb)
Wing Semispan	7.48 m (24.5 ft)

Flight Speed	53.6 m/s (120 mph)
Release Height	3.05 m (10 ft)

Nozzle Setup

Number	42
Vertical Offset	-0.35 m (-14 in)
Horizontal Offset	-0.25 m (-10 in)
Boom Span	±5.7 m (±18.7 ft)
Spacing (even)	0.28 m (11 in)

Meteorology

Wind Speed @ 2 m (6.28 ft)	4.47 m/s (10 mph)
Wind Direction	Perpendicular to Flight Path
Surface Roughness	0.0075 m (0.005 m BCPC)
Stability	Neutral
Relative Humidity	50 %
Temperature	30 deg C (86 deg F)

Test Substance / Application

Specific Gravity	1.0
Nominal Application Rate	100 ng/cm2 (0.25 lb/ac)
Swath Width	18.29 m (60 ft)
Nonvolatile Fraction	0.03
Number of Flight Lines	20

CURVE SPECIFIC PARAMETERS

Parameter	Very Fine/ Fine	Fine/ Medium	Medium/ Coarse	Coarse/ Very Coarse	
Swath Displacement	1 Swath	½ Swath	0	0	
Dv0.1	54 mm	94 mm		164 mm	225 mm
VMD (Dv0.5)	119 mm	216 mm	353 mm	463 mm	
Dv0.9	204 mm	369 mm	598 mm	789 mm	
Fraction < 141 mm	0.57	0.20	0.06	0.03	

The fine/medium droplet size category (the default value) was used in the aerial assessment.

Ground Boom

There are two ground sprayer application scenarios: low boom and high boom. The high boom scenario was used for this assessment.

Orchard

There are three orchard airblast application scenarios: Normal (Stone & Pome Fruit, Vineyard), Dense (Citrus, Tall Trees) and Sparse (Young, Dormant). The curve for Dense canopies was used for this assessment.

Mitigation Summary of Buffer Zones (based on AgDRIFT results to PRZM/EXAMS)

The drift reduction calculations based on AgDRIFT model for ground boom, orchard airblast, and aerial spray are tabulated below:

Off-Target Spray Drift Estimations Based on AgDRIFT (version 1.07)		
Application Method	Drift Amount (No Buffer)	Drift Amount (Buffer Restriction)
Ground Boom	6.05%	3.37% (25-ft)
Aerial Spray	15%	5.27% (150-ft)
Orchard Airblast	1.85%	0.89% (50-ft)

Three scenarios were compared for each case: (1) old use pattern, (2) new proposed pattern with buffer restrictions, and (3) new proposed patterns assuming no spray drift at all. EECs are expressed in ug/L. The results are shown below.

Case #1:

Iowa Corn - 1 ground spray @ 3 lb ai/A, 2" incorporation - No buffer restrictions

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	10.096	8.038	4.279	2.255	1.692	.590

Iowa Corn - 1 ground spray @ 3 lb ai/A, 2" incorporation - 25-ft buffer restrictions

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	5.694	4.770	2.634	1.488	1.128	.418

Iowa Corn - 1 ground spray @ 3 lb ai/A, 2" incorporation - No off-target spray drift

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	2.550	2.009	1.153	.580	.462	.198

Case #2:

Iowa Corn - 3 aerial sprays @ 1.5 lb ai/A, 14-day interval - No buffer restrictions

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	17.041	13.778	9.285	6.600	5.052	1.717

Iowa Corn - 3 aerial sprays @ 1.0 lb ai/A, 10-day interval - 150-ft buffer restrictions

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	5.091	4.261	2.939	1.824	1.406	.496

Iowa Corn - 3 aerial sprays @ 1.0 lb ai/A, 10-day interval - No off-target spray drift

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	1.690	1.330	.818	.460	.385	.151

Case #3:

Florida Citrus - 2 airblast applications @3.5 lb ai/A, with 30-day interval - No buffer restrictions

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	20.808	16.691	9.612	6.596	5.241	2.086

Florida Citrus - 2 airblast applications @3.5 lb ai/A, with 30-day interval - 50-ft buffer restrictions

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	20.571	16.233	9.321	6.451	5.041	1.938

Florida Citrus - 2 airblast applications @3.5 lb ai/A, with 30-day interval - No off-target spray drift

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	20.046	15.661	9.119	6.266	4.924	1.799

Case #4:

Mississippi Cotton - 6 aerial sprays @ 1.0 lb ai/A, 3-day interval - No buffer restrictions

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	26.433	22.213	16.837	9.383	7.245	2.608

Mississippi Cotton - 3 aerial sprays @ 1.0 lb ai/A, 10-day interval - 150-ft buffer restrictions

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	5.348	4.240	3.063	1.961	1.619	.652

Mississippi Cotton - 3 aerial sprays @ 1.0 lb ai/A, 10-day interval - No off-target spray drift

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	2.640	2.113	1.283	.800	.659	.316

Case #5:

North Carolina Tobacco - 1 pre-plant ground spray @ 5.0 lb ai/A, 4" incorporation - No buffer

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	40.371	31.720	16.393	9.076	6.916	2.197

North Carolina Tobacco - 1 pre-plant ground spray @ 2.0 lb ai/A, 2" incorporation - 25-ft buffer

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	14.048	11.006	5.475	3.115	2.386	.758

North Carolina Tobacco - 1 pre-plant ground spray @ 2.0 lb ai/A, 2" incorporation - No drift

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1/10	11.106	8.697	4.376	2.521	1.935	.607

Scenario # 1. Pre-plant corn risk scenario with the maximum proposed use rate:

Risk Quotients for Corn in Pottawattamie Co., Iowa (Pre-plant Ground Spray; 1 Application at 3 lbs ai/A; 2-inch Soil Incorporation) (Aquatic EEC's Based on PRZM3.12-EXAMS Model)			
Species	Exposures (μg/L) No Buffer / Buffer / No Drift	Toxicity (μg/L)	Risk Quotients No Buffer / Buffer / No Drift
Freshwater Fish Acute LC_{50}	10.1 / 5.7 / 2.55[1]	1.8	5.6 / 3.2 / 1.4
Fish Reproduction NOAEC	10.1 / 5.7 / 2.55[1] 4.2 / 2.6 / 1.15[2]	0.57	18 / 10 / 4.5 74 / 46 / 2.0
Aquatic Invertebrate Acute LC_{50}	10.1 / 5.7 / 2.55	0.10	100 / 57 / 26
Freshwater Invert. Reproduction NOAEC	10.1 / 5.7 / 2.55 4.2 / 2.6 / 1.15	0.04	250 / 140 / 64 100 / 65 / 29
Estuarine Fish Acute LC_{50}	10.1 / 5.7 / 2.55	0.96	11 / 5.9 / 2.7
Estuarine Fish Reproduction NOAEC	10.1 / 5.7 / 2.55 4.2 / 2.6 / 1.15	0.28	36 / 20 / 9.1 15 / 9.3 / 4.1
Estuarine Invertebrate Acute LC_{50}	10.1 / 5.7 / 2.55	0.035	290 / 110 / 73
Estuarine Invert. Reproduction NOAEC	10.1 / 5.7 / 2.55 4.2 / 2.6 / 1.15	< 0.0046	> 2200 / > 1200 / > 550 > 910 / > 570 / > 250
Estuarine Algae EC_{50}	10.1 / 5.7 / 2.55	140	0.07 / 0.041 / 0.0082

[1] Peak EECs in 2-meter deep pond or estuarine water
[2] 21-Day EECs in 2-meter deep pond or estuarine water

Risk Summary for Maximum Preplant Spray to Corn: Chlorpyrifos ground-sprayed as a pre-plant application at 3 lbs ai/A and soil incorporated to 2 inches yields risk quotients which **exceed both acute (RQ $\geq$ 0.5) and chronic (RQ $\geq$ 1) levels of concern for all aquatic animal groups, except algae**. Omitting risks to algae, **the lowest risk quotient posed by chlorpyrifos use on pre-plant corn is 1.4 for acute freshwater fish with no spray drift.** From the above risk quotients, it is apparent that runoff alone from corn fields treated with 3 lbs ai./A poses both acute and chronic risks to aquatic organisms in all of the above groupings. In this ground spray application scenario, the 25-foot no-spray buffer zone reduces the EECs and risks by 44 percent. However, the risk quotients for the no-drift scenario clearly show that there is no level of reduction in spray drift, which will totally mitigate chlorpyrifos risks to aquatic animals. The no-spray buffer is a clear improvement over current application methods, but the data also show that a no-spray buffer zone alone can not eliminate acute or chronic risks to sensitive aquatic animals.

Scenario # 2. Foliar corn risk scenario with three maximum aerial applications; proposed use modifications include a rate reduction from 1.5 to 1 lbs ai./A and a 10-day retreatment interval versus a previous 14-day interval.

Risk Quotients for Corn in Pottawattamie Co., Iowa (Foliar, Aerial Spray; 3 Applications at 1.5 lbs ai./A reduced to 1 lb ai/A) (Aquatic EEC's Based on PRZM3.12-EXAMS Model)			
Species	Exposures (μg/L) No Buffer / Buffer / No Drift	Toxicity (μg/L)	Risk Quotients No Buffer / Buffer / No Drift
Freshwater Fish Acute LC_{50}	17.1 / 5.1 / 1.69[1]	1.8	9.5 / 2.8 / 0.94
Fish Reproduction NOAEC	17.1 / 5.1 / 1.69[1] 9.3 / 2.9 / 0.82[2]	0.57	30 / 8.9 / 3.0 16 / 21 / 1.4
Aquatic Invertebrate Acute LC_{50}	17.1 / 5.1 / 1.69	0.10	170 / 51 / 17
Freshwater Invert. Reproduction NOAEC	17.1 / 5.1 / 1.69 9.3 / 2.9 / 0.82	0.04	430 / 130 / 42 230 / 72 / 20
Estuarine Fish Acute LC_{50}	17.1 / 5.1 / 1.69	0.96	18 / 5.3 / 1.8
Estuarine Fish Reproduction NOAEC	17.1 / 5.1 / 1.69 9.3 / 2.9 / 0.82	0.28	61 / 18 / 6.0 33 / 10 / 2.9
Estuarine Invertebrate Acute LC_{50}	17.1 / 5.1 / 1.69	0.035	490 / 150 / 48
Estuarine Invert. Reproduction NOAEC	17.1 / 5.1 / 1.69 9.3 / 2.9 / 0.82	<0.0046	> 3700 / > 1100 / > 370 > 2000 / > 630 / > 180
Estuarine Algae EC_{50}	17.1 / 5.1 / 1.69	140	0.12 / 0.036 / 0.012

[1] Peak EECs in 2-meter deep pond or estuarine water
[2] 21-Day EECs in 2-meter deep pond or estuarine water

Risk Summary for 3 Aerial, Foliar Spray Applications to Corn at the Maximum Use Rate:

Chlorpyrifos applied as three aerially, foliar spray applications at **1.5 and 1 lb ai/A yields risk quotients which exceed both the acute (RQ $\geq$ 0.5) and chronic (RQ $\geq$ 1) levels of concern for all aquatic animal groups, except algae.** Omitting the risk quotients for algae, **the lowest risk quotient posed by three aerial applications on corn is 0.94 for acute freshwater fish, which assumes no spray drift at all.** From the above risk quotients, it is apparent that runoff alone from corn fields aerially sprayed three times poses both acute and chronic risks to aquatic organisms in all of the above groupings. In this aerial spray scenario, the 150-foot no-spray buffer zone reduced the EECs and risks by 70 percent. However, the risk quotients for the no-drift scenario clearly

show that the use of no-spray buffer zones can not totally mitigate chlorpyrifos risks to aquatic animals. About 10 percent on the exposure from the application without buffer zones occurs as runoff. The no-spray buffer is a clear improvement over current application methods, but the data also show that a no-spray buffer zone alone can not eliminate acute or chronic risks to sensitive aquatic animals.

Scenario # 3. Two foliar airblast applications to Florida citrus with 30-day retreatment intervals (no changes in use rate, number of applications, or retreatment interval.

Risk Quotients for Citrus in Osceola Co., Florida (Foliar, Airblast Spray; 2 Applications at 3.5 lbs ai./A; 30-day Interval) (Aquatic EEC's Based on PRZM3.12-EXAMS Model)

Species	Exposures (μg/L) No Buffer / Buffer / No Drift	Toxicity (μg/L)	Risk Quotients No Buffer / Buffer / No Drift
Freshwater Fish Acute LC_{50}	20.8 / 20.6 / 20.0[1]	1.8	12 / 11 / 11
Fish Reproduction NOAEC	20.8 / 20.6 / 20.0[1] 9.62 / 9.32 / 9.12[2]	0.57	36 / 36 / 35 17 / 16 / 16
Aquatic Invertebrate Acute LC_{50}	20.8 / 20.6 / 20.0	0.10	210 / 210 / 200
Freshwater Invert. Reproduction NOAEC	20.8 / 20.6 / 20.0 9.62 / 9.32 / 9.12	0.04	520 / 520 / 500 240 / 230 / 230
Estuarine Fish Acute LC_{50}	20.8 / 20.6 / 20.0	0.96	22 / 22 / 21
Estuarine Fish Reproduction NOAEC	20.8 / 20.6 / 20.0 9.62 / 9.32 / 9.12	0.28	74 / 74 / 71 60 / 11 / 4.6
Estuarine Invertebrate Acute LC_{50}	20.8 / 20.6 / 20.0	0.035	590 / 590 / 570
Estuarine Invert. Reproduction NOAEC	20.8 / 20.6 / 20.0 9.62 / 9.32 / 9.12	<0.0046	> 4500 / >4500 / >4300 > 2100 / >2000 / >2000
Estuarine Algae EC_{50}	20.8 / 20.6 / 20.0	140	0.15 / 0.15 / 0.14

[1] Peak EECs in 2-meter deep pond or estuarine water
[2] 21-Day EECs in 2-meter deep pond or estuarine water

Risk Summary for 2 Foliar Air-blast Spray Applications to Citrus at Maximum Use Rate:

Chlorpyrifos applied as two foliar air-blast spray applications at **3.5 lbs ai/A yields risk quotients which exceed both the acute (RQ $\geq$ 0.5) and chronic (RQ $\geq$ 1) levels of concern for all aquatic animal groups, except algae.** Omitting the risk quotients for algae, **the lowest risk quotient posed by the foliar air-blast spray applications on Florida citrus is 11 for acute**

freshwater fish, which assumes no spray drift at all. From the above risk quotients, it is apparent that runoff alone from air-blast spray applications to citrus orchards poses both acute and chronic risks to aquatic organisms in all of the above groupings. In this aerial spray scenario, the 50-foot no-spray buffer zone only slightly reduced the EECs and risks by 1 percent. The risk quotients for the no-drift scenario clearly show that the use of no-spray buffer zones can not totally mitigate chlorpyrifos risks to aquatic animals. About 96 percent of the exposure from the application without buffer zones occurs as runoff. The no-spray buffer for air-blast applications of citrus trees is not much improvement over current application methods. Foliar interception by the trees in the orchard reduces spray drift to a very minimum. Runoff alone from the orchard poses nearly all the risk for both acute or chronic risks to sensitive aquatic animals.

Scenario # 4. Six aerial spray applications to Mississippi cotton; with proposal to reduce use to three aerial applications and 10-day retreatment intervals.

Risk Quotients for Cotton in Jackson Co., Mississippi (Foliar, Aerial Spray; 6 versus 3 Applications at 1 lb ai./A) (Aquatic EEC's Based on PRZM3.12-EXAMS Model)			
Species	Exposures (µg/L) No Buffer / Buffer / No Drift	Toxicity (µg/L)	Risk Quotients No Buffer / Buffer / No Drift
Freshwater Fish Acute LC_{50}	26.4 / 5.35 / 2.64[1]	1.8	15 / 3.0 / 1.5
Fish Reproduction NOAEC	26.4 / 5.35 / 2.64[1] 16.8 / 3.06 / 1.28[2]	0.57	46 / 9.4 / 4.6 29 / 5.4 / 2.2
Aquatic Invertebrate Acute LC_{50}	26.4 / 5.35 / 2.64	0.10	260 / 54 / 26
Freshwater Invert. Reproduction NOAEC	26.4 / 5.35 / 2.64 16.8 / 3.06 / 1.28	0.04	660 / 130 / 66 420 / 76 / 32
Estuarine Fish Acute LC_{50}	26.4 / 5.35 / 2.64	0.96	28 / 5.6 / 2.8
Estuarine Fish Reproduction NOAEC	26.4 / 5.35 / 2.64 16.8 / 3.06 / 1.28	0.28	94 / 11 / 9.4 60 / 11 / 4.6
Estuarine Invertebrate Acute LC_{50}	26.4 / 5.35 / 2.64	0.035	754 / 153 / 75
Estuarine Invert. Reproduction NOAEC	26.4 / 5.35 / 2.64 16.8 / 3.06 / 1.28	<0.0046	> 5700 / > 1200 / > 570 > 3700 / > 670 / > 280
Estuarine Algae EC_{50}	26.4 / 5.35 / 2.64	140	0.19 / 0.038 / 0.019

[1] Peak EECs in 2-meter deep pond or estuarine water
[2] 21-Day EECs in 2-meter deep pond or estuarine water

Risk Summary for Aerial, Foliar Spray Applications to Cotton at the Maximum Use Rate:

Chlorpyrifos applied as six and reduced to three aerial, foliar spray applications at **1.0 lb ai/A yields risk quotients which exceed both the acute (RQ $\geq$ 0.5) and chronic (RQ $\geq$ 1) levels of concern for all aquatic animal groups, except algae.** Omitting the risk quotients for algae, **the lowest risk quotient posed by three aerial applications on cotton is 1.5 for acute freshwater fish, which assumes no spray drift at all.** From the above risk quotients, it is apparent that runoff alone from cotton fields aerially sprayed three times poses both acute and chronic risks to aquatic organisms in all of the above groupings. In this aerial spray scenario, the 50-foot no-spray buffer zone reduced the EECs and risks by 80 percent. However, the risk quotients for the no-drift scenario clearly show that the use of no-spray buffer zones can not totally mitigate chlorpyrifos risks to aquatic animals. About 10 percent of the exposure from the application without buffer zones occurs as runoff. The no-spray buffer is a clear improvement over current application methods, but the data also show that a no-spray buffer zone alone can not eliminate acute or chronic

risks to sensitive aquatic animals.

Scenario # 5. One Pre-plant Ground Application to North Carolina Tobacco; with proposal to reduce use rate to 2 lbs ai./A from 5 lbs ai./A and 2" soil incorporation versus 4".

Risk Quotients for Tobacco in Wake Co., North Carolina (Pre-plant, Ground Spray; 5 lbs ai./A & 4" incorportation versus 2 lbs ai./A & 2" incorp.) (Aquatic EEC's Based on PRZM3.12-EXAMS Model)

Species	Exposures (μg/L) No Buffer / Buffer / No Drift	Toxicity (μg/L)	Risk Quotients No Buffer / Buffer / No Drift
Freshwater Fish Acute LC_{50}	40.4 / 14.0 / 11.1[1]	1.8	2.2 / 7.8 / 6.2
Fish Reproduction NOAEC	40.4 / 14.0 / 11.1[1] 16.4 / 5.48 / 4.38[2]	0.57	71 / 25 / 19 29 / 9.6 / 7.7
Aquatic Invertebrate Acute LC_{50}	40.4 / 14.0 / 11.1	0.10	400 / 140 / 110
Freshwater Invert. Reproduction NOAEC	40.4 / 14.0 / 11.1 16.4 / 5.48 / 4.38	0.04	1000 / 350 / 180 410 / 140 / 110
Estuarine Fish Acute LC_{50}	40.4 / 14.0 / 11.1	0.96	42 / 15 / 12
Estuarine Fish Reproduction NOAEC	40.4 / 14.0 / 11.1 16.4 / 5.48 / 4.38	0.28	140 / 18 / 40 59 / 20 / 16
Estuarine Invertebrate Acute LC_{50}	40.4 / 14.0 / 11.1	0.035	1200 / 400 / 320
Estuarine Invert. Reproduction NOAEC	40.4 / 14.0 / 11.1 16.4 / 5.48 / 4.38	<0.0046	> 8800 / >3000 / >2400 > 3600 / >1200 / > 950
Estuarine Algae EC_{50}	40.4 / 14.0 / 11.1	140	0.29 / 0.10 / 0.079

[1] Peak EECs in 2-meter deep pond or estuarine water
[2] 21-Day EECs in 2-meter deep pond or estuarine water

Risk Summary for 1 Pre-plant Ground Spray Application to Tobacco at Maximum Use Rate:

Chlorpyrifos applied as a single pre-plant ground spray application at **5 lbs ai/A with 4" soil incorporation reduced to 2 lbs ai/A with 2" soil incorporation yields risk quotients which exceed both the acute (RQ $\geq$ 0.5) and chronic (RQ $\geq$ 1) levels of concern for all aquatic animal groups, except algae.** Omitting the risk quotients for algae, **the lowest risk quotient posed by the pre-plant ground spray application on tobacco is 6.2 for acute freshwater fish, which assumes no spray drift at all.** From the above risk quotients, it is apparent that runoff alone from tobacco fields ground sprayed poses both acute and chronic risks to aquatic organisms in all of the above groupings. In this aerial spray scenario, the 25-foot no-spray buffer zone reduced the EECs and risks by 65 percent. However, the risk quotients for the no-drift scenario

clearly show that the use of no-spray buffer zones can not totally mitigate chlorpyrifos risks to aquatic animals. About 27 percent of the exposure from the application without buffer zones occurs as runoff. The no-spray buffer is a clear improvement over current application methods, but the data also show that a no-spray buffer zone alone can not eliminate acute or chronic risks to sensitive aquatic animals.

Conclusions: The no-spray zones proposed by Dow AgroSciences each reduce the risks to aquatic animals compared to the current use methods. However, none of the buffer zones totally mitigate the risks to aquatic animals. The no-spray drift assessment indicates that spray drift restrictions alone can not totally mitigate risks for even one aquatic group. According to the PRZM-EXAMS Model, the EECs from runoff of chlorpyrifos from treated fields, alone, are sufficiently high to pose risks to all aquatic animal categories, both acute and chronic.